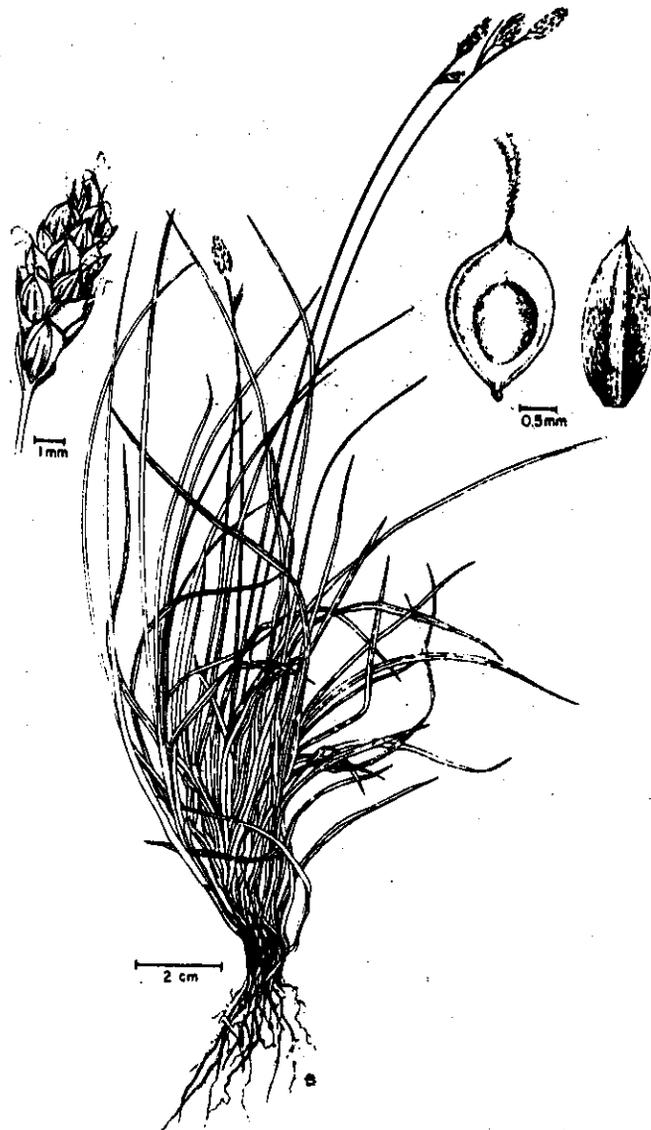


NAVAJO SEDGE

(Carex speculicola)

RECOVERY PLAN



RECOVERY PLAN

for

Navajo Sedge

Carex specuicola J.T. Howell

Prepared by

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for

U.S. Fish and Wildlife Service, Region 2

Approved:

Acting

Russell J. Carnot
Regional Director, Region 2

Date:

24 Sept. 1987

DISCLAIMER

This completed Navajo Sedge Recovery Plan has been approved by the U.S. Fish and Wildlife Service. The Plan does not necessarily represent official positions, approvals of cooperating agencies, or the views of all individuals who played a role in its preparation. This plan is subject to modification as dictated by new findings, changes in the species' status, and completion of tasks described in the plan. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities, and other constraints.

Literature citation should read as follows:

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We wish to thank Edward Olson and Melinda Roth of the Bureau of Indian Affairs for their information in preparation of this plan. The field assistance of Jackie Poole, of the Texas Natural Heritage Program is also appreciated. A special thanks to the Inscription House Community.

SUMMARY

- Goal: To remove the threatened Navajo sedge (Carex specuicola) from the Federal list of threatened and endangered species by managing its essential habitat to sustain natural populations in the wild.
- Recovery Criteria: The criteria for delisting the Navajo sedge have not yet been determined. The implementation of studies in this recovery plan will provide the necessary data from which quantified delisting criteria can be established.
- Actions Needed: Major steps to meet the objective of this recovery plan include: permanent protection of all known habitat; inventory of potential habitat; establishment of monitoring plots; development and implementation of a habitat management plan; reintroduction of Carex specuicola onto protected sites; documentation of hydrological potential in habitat area; and demonstration of long term stability of populations and habitat.

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PART I

INTRODUCTION

Brief Overview

The Navajo sedge, Carex specuicola J.T. Howell, was listed as a threatened species on June 7, 1985 (USFWS 1985) by the U.S. Fish and Wildlife Service. Carex specuicola is a member of the sedge family (Cyperaceae) and is the only species in this family that is Federally listed as threatened or endangered.

Carex specuicola is endemic to the Navajo Nation. The only two verified populations occur near Inscription House, Coconino County, Arizona (Figure 1). The species is now restricted to Navajo Sandstone seeps or hanging gardens.

Carex specuicola was first collected by J.T. Howell in June 1948, along the Inscription House Ruin Trail. No specimens of this species are known to have been collected from 1948 until 1980, when Phillips et al. (1981) discovered the species and provided data that indicated that Carex specuicola was rare. The population along the trail was found in 1980 to comprise three subpopulations, and in 1986 Navajo Natural Heritage Program personnel verified an additional population in Toenleshushe Canyon and identified five potential habitat sites.

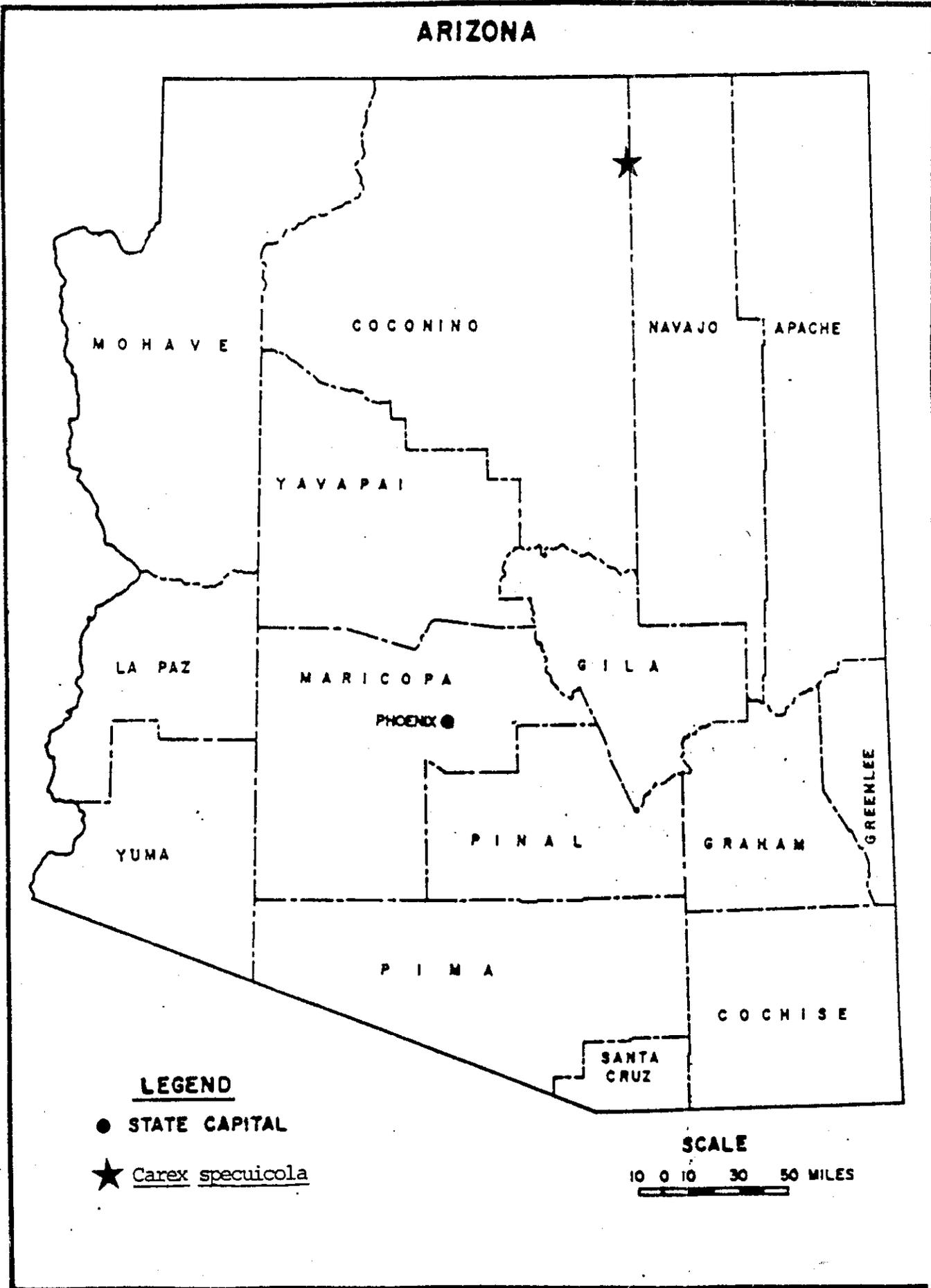


Figure 1. Distribution of *Carex specuicola* in Arizona.

Members of the Inscription House Chapter of the Navajo Nation know this plant as "yellow hay" and "food for the animals" and are aware that it is a riparian plant. They say that the species was once widespread, even in the lowlands, wherever water was abundant. Although traditional uses of the Navajo sedge have not yet been identified, potential uses deserve investigation.

Taxonomy and Morphology

The type locality for Carex specuicola is along the Inscription House Ruin Trail to Navajo National Monument, Arizona. The species was described by J.T. Howell (1949) in the Leaflets of Western Botany. The type specimen is housed at the California Academy of Sciences Herbarium.

Carex specuicola is unusual in having both two-branched styles with lenticular achenes, and three-branched styles with trigonous achenes. In Section Atratae of the Cyperaceae, Carex specuicola resembles Carex heteroneura in having small, greenish-white perigynia and in having conspicuously nerved scales, but it differs from that species in its strongly papillose and serrulate perigynia and beaks. In those characters, Carex specuicola resembles Carex atrata L. and closely related species, a group that is well developed in the Rocky Mountains (Phillips et al. 1981).

Carex specuicola is a slender, perennial forb, 2.5 to 4.5 dm (10 to 18 inches) high. The triangular stem extends from an

elongate, slender rhizome. The leaves are pale green, 1 to 2 mm mm (<0.1 inch) wide, 12 to 20 cm (about 5 to 8 inches) long, and are clustered near the plant's base. The flowers are concentrated in 2 to 4 groups or spikes. The terminal spike has both male and female flowers, with the female flowers situated above the male flowers. The flowers are reduced and inconspicuous; they consist of small green-brown, scale-like parts 2 to 3 mm (<0.12 inch) long and 1 to 1.5 mm (<0.06 inch) wide. Flowering and fruit set occur from spring through summer, but most reproduction appears to be vegetative (Hermann 1970).

Current Status

Present and Past Distribution and Abundance

This rare endemic species is currently limited in distribution to only two known populations: one in the Inscription House Ruin area and the second in Toenleshushe Canyon (Table 1). The historic distribution is not known because of the remoteness of the populations; however, the species may have occurred on lower riparian lands and in other canyons on the Navajo Nation (C. Dayzie and E. Benally, pers. comm. 1986).

The population along Inscription House Ruin Trail comprises three subpopulations (Table 1) that occur along the same canyon and seep. The site of subpopulation 1A has a developed water well and a corral; Carex specuicola is matted along the side of

Table 1

Carex specuicola

Occurrence, Size, and Ownership of Population Sites

SITE NAME	LOCATION	NO. OF INDIVIDUALS		LAND STATUS
		1986	1980	
Population 1	Inscription House Ruin			
Subpopulation 1A		300	300	Navajo Trust Lands
Subpopulation 1B		< 30	200	Navajo Trust Lands
Subpopulation 1C		100	100	Navajo Trust Lands
Population 2	Toenleshushe Canyon			
Subpopulation 2A		75	NS*	Navajo Trust Lands
Potential Subpopulation 2B		Unknown	NS	Navajo Trust Lands
Potential Subpopulation 2C		Unknown	NS	Navajo Trust Lands
Potential Population 3	Geshi Canyon	Unknown	NS	Navajo Trust Lands
Potential Population 4	Geshi Canyon	Unknown	NS	Navajo Trust Lands
Potential Population 5	Geshi Canyon	Unknown	NS	Navajo Trust Lands

*NS means Not Surveyed

the well and corral, and extends along the canyon where it becomes inaccessible. This subpopulation contains an estimated 300 individuals. The well and corral locations have been grazed and trampled by livestock.

The site of subpopulation 1B also has a corral and is along the trail to Inscription House Ruin. In 1981 an estimated 200 individuals existed there (Phillips et al. 1981) and in 1985-1986 Navajo Natural Heritage Program personnel observed no individuals in the corral but estimated less than 30 next to the corral. This subpopulation has been severely grazed by livestock.

Subpopulation 1C is located at the same elevation as the other seeps and is inaccessible. In 1985-86 Navajo Natural Heritage Program personnel observed no impacts on this subpopulation and estimated 100 individuals. Grazing by goats may be the only threat to this subpopulation.

The other Carex specuicola population is located in Toenleshushe Canyon and was found by the Navajo Natural Heritage Program personnel in 1986 and consists of only about 75 individuals. Two additional potential subpopulation sites were located in 1985 in this canyon but are as yet unsurveyed.

In 1986 Navajo Natural Heritage Program personnel located three potential sites for Carex specuicola in Geshi Canyon (Table 1). Because these sites are on sheer cliff faces, access is difficult and they have yet to be surveyed.

Habitat and Dominant Associated Species

Carex specuicola occurs in hanging gardens within the Great Basin Conifer Woodland (Brown and Lowe 1980). The seep-spring pockets are on Navajo Sandstone Formation bedrock at an elevation of 1740 to 1824 m (5710 to 5980 feet). Carex specuicola grows in a variety of situations on Navajo Sandstone, ranging from almost inaccessible sheer cliff faces to accessible alcoves. The annual precipitation is approximately 194 mm (7.6 inches) (Sellers and Hill 1974).

The dominant associated species that are found with Carex specuicola include Mimulus Eastwoodiae (monkey flower), Epipactis gigantea (helleborine), Agrostis semiverticillata (water bentgrass), Andropogon hallii (sand bluestem), Cirsium sp. (thistle), Hordeum jubatum (foxtail barley) and Phragmites communis (common reed) (Phillips et al. 1981). Although Hordeum jubatum was noted by Phillips et al. (1981), it was not observed in the 1986 field season by Navajo Natural Heritage Program personnel.

Impacts and Threats

Most species of Carex are palatable to livestock and, although the forage value of Carex specuicola is unknown, it is suspected that domestic livestock (horses, sheep, goats and cows) and wildlife graze the plants. The two major threats to Carex specuicola are grazing of accessible sites and lowering of the water table by water development. Three of the four subpopulations are accessible to domestic livestock and two of these three subpopulations have been significantly impacted by grazing and trampling. Subpopulation 1B in Inscription House Ruin area has drastically declined from an estimated 200 individuals in 1980 (Phillips et al. 1981) to less than 30 individuals observed by Navajo Natural Heritage Program personnel in 1986. This dramatic decline was due to grazing within a corral that was inadvertently constructed around the subpopulation. Inside the corral, a few monkey flowers, inaccessible to grazing, occur and thistles now dominate the seep. Microhabitat changes owing to the loss of cover from these plants may threaten the continued existence of the Navajo sedge at this site. Grazing has also occurred in subpopulation 1A although the impacts are not as severe as in subpopulation 1B.

Water is vital to the survival of the Navajo sedge; thus, any change in the water table level will have an effect on the populations. Water development (e.g. for wells, troughs) has already affected subpopulation 1A. This water development has

caused livestock to congregate in the area and forage on Carex specuicola. Additional factors and potential threats including water source improvement, capturing free-flowing water, reduction of flows, channelization of flows and seasonal interference of flows will be investigated to determine their impacts on the Navajo sedge and its habitat.

Accessible habitat in and around Inscription House Ruin Trail may develop off-road vehicle (ORV) problems. In 1985, Navajo Natural Heritage Program personnel observed ORV tracks along Inscription House Ruin Trail. Motorcycles are replacing horses for herding livestock and are being used more frequently for recreational access to the ruins.

The endemism and rarity of Carex specuicola make it vulnerable to collection. Collection by scientists, and other interested parties could affect the species' populations.

PART II

RECOVERY

OBJECTIVE

The main objective of this recovery plan is to protect Carex specuicola and manage its essential habitat so that healthy populations can be sustained in their natural habitats. To meet this objective, the following actions are required:

1. Permanently protect all known habitats according to the steps outlined in this plan.
2. Inventory suitable potential habitat.
3. Census and monitor known populations and establish permanent monitoring plots at these sites.
4. Develop and implement a habitat management plan.
5. Develop formal documentation outlining long-term hydrological potential of the existing and potential habitat of Carex specuicola.
6. Reintroduce Carex specuicola onto several protected sites within its inferred historic range.
7. Demonstrate long-term stability of populations and habitat.

The limited amount of study on this species makes it presently impossible to quantify habitat and abundance in the manner needed to establish delisting criteria. Further study of this species will provide data necessary to establish these criteria.

Step-Down Outline

1. Protect existing populations of Carex specuicola by removing threats to the species and by managing its habitat.
 11. Enforce existing laws and regulations.
 12. Develop a cooperative agreement between U.S. Fish and Wildlife Service, and Bureau of Indian Affairs (BIA), and the Navajo Nation.
 13. Develop and implement a habitat management plan to protect Carex specuicola and its habitat on Navajo Nation lands.
 131. Develop management guidelines for grazing.
 1311. Assess land status.
 1312. Assess grazing permit system.
 1313. Close habitat areas to grazing.
 132. Develop guidelines for water development.
 133. Manage ORV use in the population areas.

134. Develop guidelines for maintenance of Inscription House Ruin Trail.
 135. Assess the potential impacts of housing and road development in the area.
 136. Protect the habitat of Carex specuicola as natural areas.
 137. Develop a specific threatened and endangered species botanical permit for the Reservation.
14. Establish stations to monitor the water table in the two main population areas.
 15. Prepare an assessment of the hydrologic development potential on Carex specuicola habitat.
2. Study the populations in their natural habitat.
 21. Establish monitoring plots to study ecological requirements of Carex specuicola.
 211. Assess soil needs of the plant.
 212. Assess water needs of Carex specuicola.

213. Assess the role of the Navajo sedge in the dynamics of the hanging garden community.
22. Establish monitoring plots to study population biology.
 221. Study the mechanism of wind pollination.
 222. Study the dispersal mechanism.
 223. Study phenology and seed set.
 224. Assess the impact of exotic invader species on Carex specuicola populations.
 225. Study the role of biotic factors in Carex specuicola ecology.
 2251. Herbivores.
 2252. Other organisms.
23. Inventory suitable potential habitat.
3. Conduct experimental growth studies and re-establish Carex specuicola on protected land.

31. Conduct laboratory/greenhouse studies on Carex specuicola.
32. Re-establish Carex specuicola on protected land within its historic range.
4. Research traditional uses and potential uses of Carex specuicola by the Navajo Tribe and other Indian Tribes.
5. Develop and implement a public education and awareness program for the preservation of Carex specuicola.

Narrative

1. Protect existing populations of Carex specuicola by removing threats to the species and by managing its habitat.

Navajo sedge populations occur on Navajo Trust lands. The BIA and Navajo Nation should cooperatively protect Carex specuicola by enforcing existing regulations and developing management policies to remove threats to the species.

11. Enforce existing laws and regulations.

All existing regulations for the protection of threatened and endangered species on Navajo Nation lands need to be enforced. These regulations include the Endangered Species Act, the Lacey Act, applicable Navajo Codes and Navajo Enforcers. The implementation of these laws is a priority 1 task necessary to prevent the extinction of the species.

12. Develop a cooperative agreement between U.S. Fish and Wildlife Service, and BIA, and the Navajo Nation.

A cooperative agreement between USFWS and BIA and the Navajo Nation is necessary to coordinate and expedite the management and protection of Carex specuicola populations.

13. Develop and implement a habitat management plan to protect *Carex specuicola* and its habitat on Navajo Nation lands.

To ensure the protection of existing populations, BIA and Navajo Nation need to cooperatively develop a habitat management plan (HMP). The HMP should provide site-specific procedures for protection of the plants from such activities as grazing, ORV use, and water developments. Because the Navajo sedge is so close to extinction, the development of an HMP is a priority 1 task necessary to prevent irreversible decline of the species.

131. Develop management guidelines for grazing.

BIA and Navajo Nation should develop grazing guidelines that include elimination of grazing on Navajo sedge habitat because the species is particularly vulnerable to grazing. The plan should address present and future range facility placement (e.g., of corrals, water troughs, salt sources) in and near *Carex specuicola* habitat.

1311. Assess land status.

BIA and Navajo Nation should cooperatively prepare an assessment of land status and land users within Navajo sedge habitat.

Grazing use and corral use should be included in the assessment.

1312. Assess grazing permit system.

BIA and Navajo Nation should evaluate the current grazing permit system and impacts that the system has on Carex specuicola habitat. BIA should incorporate protection for this and other Federally listed plants into the Federal grazing permit.

1313. Close habitat areas to grazing.

Completely enclose populations accessible to livestock by building stone masonry walls. Closure by masonry is necessary so that fencing cannot be used to make a corral.

132. Develop guidelines for water development.

BIA and Navajo Nation need to cooperatively develop guidelines for water development (such as water source improvement, capturing free-flowing water, reduction of flows, channelization of flows, etc.) that may impact Navajo sedge habitat. These guidelines may be continuously updated as more data are compiled.

133. Manage ORV use in the population areas.

BIA and Navajo Nation should develop guidelines for ORV use near accessible habitat.

Navajo sedge populations should be monitored to determine if ORV restrictions need to be implemented. Development of a plan to control ORV use in Carex specuicola habitat should be included in the habitat management plan.

134. Develop guidelines for maintenance of Inscription House Ruin Trail.

BIA and Navajo Nation need to develop cooperative guidelines for maintenance of Inscription House Ruin Trail to ensure that maintenance will not impact Carex specuicola habitat.

135. Assess the potential impacts of housing and road development in the area.

BIA and Navajo Nation should evaluate the likely impacts of potential housing and road development on the water table upon which Carex specuicola depends.

136. Protect the habitat of Carex specuicola as natural areas.

Navajo Nation should consider protecting Carex specuicola habitat by granting it a special land

use status such as a natural area designation. Navajo Nation has the authority to withdraw land for special land status. Currently, the Nation has no land that has been withdrawn for protection of any Federal threatened and endangered species or rare species.

137. Develop a specific threatened and endangered species botanical permit for the Reservation.

BIA and Navajo Nation should coordinate to develop a permit system that will regulate plant collecting (e.g., of plants, seeds, tissue, transplanting) and monitor observers (i.e. BIA and Navajo employees, scientists, private individuals). A U.S. Fish and Wildlife Service permit is required for all threatened and endangered species work on Federal lands. The proper management of the species depends on the ability to identify all people working with the species.

14. Establish stations to monitor the water table in the two main population areas.

BIA and Navajo Nation should cooperatively research and develop an effective water table monitoring plan. Implementation of this plan is essential to assess cumulative impacts.

15. Prepare an assessment of the hydrologic development potential on Carex specuicola habitat.

The hydrology of the region plays a vital role in the existence of Carex specuicola. Because of the importance of available water to the continued survival of the species, BIA and Navajo Nation need to address the existing and potential water use from the water table on which the Navajo sedge depends. In addition, the cumulative impacts of developments on the water table need to be determined.

2. Study the populations in their natural habitat.

Because of the Navajo sedge's rarity and limited distribution, in-depth ecological and population biology studies are essential for its proper management. A comprehensive and ongoing monitoring program is a critical element in determining the present and future status of the Navajo sedge. Establishment of monitoring plots that are read yearly is necessary for determination of long-term population and habitat stability. The research should focus on the species' life history, environmental requirements, and vulnerability to threats.

21. Establish monitoring plots to study ecological requirements of Carex specuicola.

Studies on the geological/edaphic site characteristics will reveal factors influencing the distribution of

Carex specuicola. This information will provide an estimate of total habitat available and the type of management necessary for the species.

211. Assess soil needs of the plant.

Soil factors such as chemical composition, texture, structure, aeration, temperature, and relation to parent material need to be determined.

212. Assess water needs of Carex specuicola.

Carex specuicola occurs only in seeps and/or water-saturated soil, which indicates that very wet local conditions are crucial to its existence. The minimum and maximum hydrologic threshold for the species needs to be determined.

213. Assess the role of the Navajo sedge in the dynamics of the hanging garden community.

Autecological factors, succession, and natural plant competitors need to be studied for a better understanding of the species and its habitat, as well as for proper management of the species.

22. Establish monitoring plots to study population biology.

Permanent plots to monitor changes in vigor, density, frequency, and fecundity should be established in each population. These plots will provide data on population

changes. The flux of individuals is of vital importance for a species existing near extinction. This information is needed for proper management and conservation of the species to ensure its survival.

221. Study the mechanism of wind pollination.

A study of wind pollination needs to be done to determine requirements for successful pollination.

222. Study the dispersal mechanism.

Dispersal studies should be conducted to determine the major vectors of dispersal within and between population areas.

223. Study phenology and seed set.

The phenology and seed set need to be considered in developing specific management recommendations for maximum survival of this species.

224. Assess the impact of exotic species on Carex specuicola populations.

Within several Navajo sedge populations, large areas of thistle (Cirsium) are dominating the habitat. Whether the thistle is a native species or exotic species needs to be determined.

225. Study the role of biotic factors in Carex specuicola ecology.

Biotic factors influencing the survival of Carex specuicola must be studied. Knowledge of such factors may facilitate the recovery of the species.

2251. Herbivores.

Domestic livestock range in the area, and browsing has been observed on Carex specuicola. The effect of this browsing needs to be studied. In addition, the unknown effects of small mammal herbivores on the species needs to be investigated.

2252. Other organisms.

Other organisms include soil organisms such as nitrogen-fixing bacteria, mycorrhizal fungi, pathologic fungi and bacteria, and parasites. These organisms may play important roles in the ecology of the species.

23. Inventory suitable potential habitat.

To properly manage the Navajo sedge, a complete inventory needs to be conducted to map the exact range of the species and to determine if there are any more

populations. Inventories should be done in canyons both north and south of the known populations.

3. Conduct experimental growth studies and re-establish *Carex specuicola* on protected land.

Because *Carex specuicola* has such a limited range, the potential for growing the species in the greenhouse and then transplanting plants into the field needs to be determined. These studies will assist in future re-establishment efforts.

31. Conduct laboratory/greenhouse studies on *Carex specuicola*.

To develop a better understanding of the biology of the Navajo sedge, laboratory/greenhouse studies on certain aspects of its growth and development are necessary. Studies should address germination requirements, vernalization, dormancy, and the potential for anti-herbivory compounds in the seed. A comparison of the germination requirements of the two types of achenes should also be studied. The finding of anti-herbivory compounds in the seed and the timing of field germination are useful information for managing the natural populations.

32. Re-establish *Carex specuicola* on protected land within its historic range.

Because *Carex specuicola* exists at only two populations, its survival is tenuous. Recovery of this species

depends on the species' re-establishment on potential habitat within its historic range. Protection of the areas where the species is planted is imperative.

4. Research traditional uses and potential uses of *Carex specuicola* by Navajo Nation and other Indian Tribes.

Research on traditional uses of the Navajo sedge (e.g., medicinal, functional) should be conducted. If a traditional use is found, it would be important for the Navajo Nation to protect such a valuable cultural and economic resource. Traditional users could provide more locational information on the species. Potential, non-traditional uses of *Carex specuicola* should also be investigated.

5. Develop and implement a public education and awareness program for the preservation of *Carex specuicola*.

To protect Navajo sedge populations on the Navajo Nation, an educational program for the Tribe needs to be developed. This program should enlist the support of the Inscription House Chapter and individuals affected because the species occurs within their Chapter. The cooperation of the Tribe is integral to the recovery and management of the Navajo sedge. The educational program may include pamphlets, interpretive signs, displays and slide shows for school and public meeting use. In addition to the educational program, tribal enterprises, the Public Health Service, and BIA agencies must be kept informed of the known occurrences and newly found populations of *Carex specuicola*.

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PART III

IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and costs for the Navajo sedge recovery program. It is a guide for meeting the objectives elaborated in Part II of this plan. This schedule indicates the general category for implementation, recovery plan tasks, corresponding task numbers, task priorities, duration of tasks ("ongoing" denotes a task that once begun should continue on an annual basis), the responsible agencies, and lastly, estimated costs for FWS tasks. These actions, when accomplished, should bring about the recovery of Navajo sedge and protect its habitat. It should be noted that monetary needs for agencies other than FWS are not identified and therefore Part III does not reflect the total financial requirements for the recovery for this plant.

General Categories for Implementation Schedule

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Recovery Action Priorities

- 1 = an action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- 2 = an action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
- 3 = all other actions necessary to provide for full recovery of the species.

Abbreviations Used

- FWS - USDI Fish and Wildlife Service
 SE - Office of Endangered Species
 LE - Law Enforcement
 NN - Navajo Nation
 IHS - Indian Health Services

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY	PLAN TASK NUMBER	TASK NUMBER	PRIORITY NUMBER	TASK DURATION	RESPONSIBLE AGENCY		FISCAL YEAR COSTS*			COMMENTS
					FWS	OTHER	FY1	FY2	FY3	
					REGION	PROGRAM				
02	Enforce existing laws	11	1	ongoing	2	LE	BIA NN	5,000	5,000	5,000
M7	Develop cooperative agreement between FWS, BIA, and NN	12	2	1 year ongoing	2	SE	BIA NN	2,000	2,000	2,000
M3	Develop & implement a HMP	13	1	ongoing			BIA NN			
R1	Establish stations to monitor the water table	14	2	ongoing			BIA NN			
I14	Prepare an assessment of hydrologic development potential	15	2	1 year			BIA NN IHS			
R3	Establish monitoring plots to study ecological requirements	21	2	3-5 years	2	SE	BIA NN	10,000	10,000	10,000

PART III IMPLEMENTATION SCHEDULE

GENERAL CATEGORY	PLAN TASK	TASK NUMBER	PRIORITY NUMBER	TASK DURATION	RESPONSIBLE AGENCY		FISCAL YEAR COSTS*			COMMENTS
					FWS	OTHER	FY1	FY2	FY3	
R1, R6	Establish monitoring plots to study population biology	22	2	5 years	2	SE BIA NN	10,000	10,000	10,000	
I14	Inventory potential habitat	23	2	3-5 years	2	SE BIA NN	10,000	10,000	10,000	
M1	Conduct laboratory/greenhouse studies	31	2	5 years	2	SE	5,000	5,000	5,000	
M2	Re-establish <u>Carex specuicola</u> on protected land within its historic range	32	2	5 years	2	SE	15,000	15,000	15,000	
I14	Research tribal uses of <u>Carex</u>	4	3	2 years		NN				
O1	Develop & implement public education	5	3	ongoing	2	SE BIA NN	3,000	3,000	3,000	

*Costs refer to USFWS expenditures only.

APPENDIX

List of Reviewers

A technical/agency review draft of the Navajo Sedge Recovery Plan was sent to the following individuals and agencies on December 9, 1986.

Mr. Andy Laurenzi
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Tucson, AZ 85717

Dr. Gary Nabhan
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Comments Received

Comment letters are reproduced in this section followed by the Service's response to each comment. Some reviewers submitted part or all of their comments marked directly on the draft plan. These comments have not been reproduced.



Mr. Jack Woody

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D-4 Sections 12 and 13 are essentially the same and should either be combined or redefined.

D-5 Section 3 studies should include a comparison of the germination and establishment requirements for the two achene types. Production of the two types should also be studied to see if there are any differences. Field plots relative to section 24 could then be established utilizing information obtained.

D-6 Sections 1413, "close habitat areas to grazing" and 142, "develop guidelines for water development" are the primary and most immediate factors necessary to the continued survival of this species. Whether this be done by fencing or removal of livestock, it needs to be done quickly. The current situation also needs to be assessed to determine whether or not these activities are presently violating the Endangered Species Act. Existing water and other livestock developments that adversely affect the species need to be removed and relocated elsewhere.

Those areas where livestock will be removed can be reevaluated as the species recovers to determine how much, if any, use of the area and of the plant itself can be tolerated.

D-7 On page 4 under Present and Past Distribution and Abundance, there is an implication that C. specuicola "may have occurred on lower riparian lands and in other canyons." An evaluation of adjacent watersheds and portions of watersheds need to be made to determine if they can be rehabilitated by livestock removal and structure placement to increase sustained water flows or to rewet former springs and seeps thereby augmenting existing habitat.

In general, the draft Recovery Plan includes steps necessary to at least progress toward recovery of C. specuicola. Periodic reassessments will allow needed refinement as our knowledge of this plant increases.

Sincerely,

REGGIE FLETCHER
Regional Botanist



Responses to Comments

- A-1 Task 144 was corrected by removing NPS from responsibility for maintenance of the trail.
- A-2 Comment noted.
- B-1 Comments incorporated.
- B-2 Comment incorporated.
- B-3 Comment incorporated.
- C-1 Comments noted.
- D-1 Comments noted.
- D-2 The numbers of individuals given in Table 1 is an estimate. Because the delineation of both individuals and clumps is difficult the important factor is the amount of habitat area that the species occupies.
- D-3 Critical habitat for Carex specuicola needs to be reevaluated to include the most recently discovered population. Prior to reevaluation, other potential sites need to be surveyed.
- D-4 Comment incorporated.
- D-5 Comment incorporated.
- D-6 Comments noted.
- D-7 The survey of potential habitat under Task 23 will include evaluating adjacent canyons as reintroduction sites. There is only one major watershed in that area on the Navajo Nation.